INTRODUCTION

The federal government regulates radioactive material packaging, labeling, and transport. The labels used on packages of radioactive material can be used to help you obtain information about the activity and radiation level of the material within the package. Having knowledge of the radiation levels associated with packages of radioactive material can help you determine whether damage to a package has occurred.

This module provides information about radioactive material packaging and radiation levels associated with the radiation-warning labels used in radioactive material transport.

PURPOSE

The purpose of this module is to increase your understanding of the information contained on warning labels and the radiation levels associated with radioactive material packages. Being able to correctly read the warning labels can help you assess the radioactive material package integrity, which in turn will improve your ability to respond safely.

MODULE OBJECTIVES

Upon completion of this module, you will be able to:

1. Identify radiation levels associated with the various radiation-warning labels.
2. Identify the importance of the transport index in determining package integrity.
3. Identify the maximum radiation levels expected on shipping packages and/or transport vehicle surfaces.

notes

notes

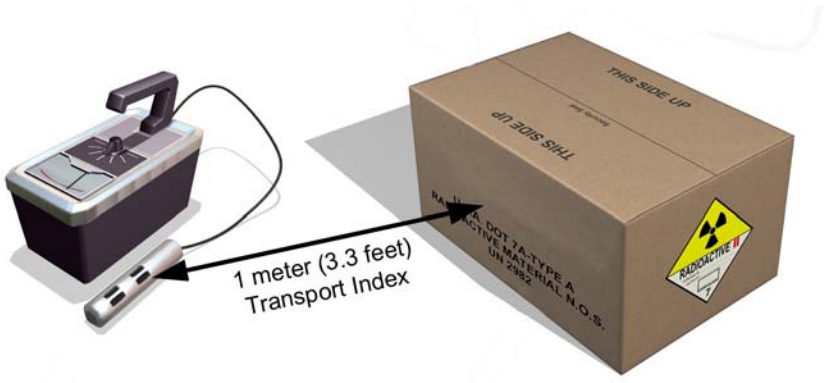
RADIATION LEVELS ASSOCIATED WITH RADIOACTIVE MATERIAL PACKAGES

The U.S. Government regulates domestic shipments of radioactive material. The U.S. Nuclear Regulatory Commission (NRC) and the U.S. Department of Transportation (DOT) share this responsibility. The areas regulated include the packaging, contents, radiation levels, and various transport requirements, including labeling and shipping papers.

Before transport, shippers of radioactive material are required to check the radiation levels of packages to ensure that all levels are within allowed limits. Radiation levels are checked on the packaging surface and at one meter (3.3 feet) from the package.

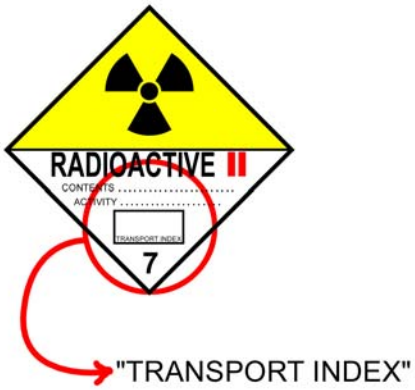
TRANSPORT INDEX (TI)

The transport index, often called the TI, is the dimensionless number[1] placed on the label of a package to designate the degree of control to be exercised by the carrier during transportation. The TI is, in most cases, equal to the maximum radiation level in mrem/hour at one meter from an undamaged package. The TI can be an indicator for determining the external radiation hazard of an undamaged package and can be a starting point for determining whether or not damage has occurred.



[1] Dimensionless number means that there are no units of measure (e.g., mrem) associated with the transport index.

For example, a package with a Radioactive Yellow-III label attached and a TI marked on the label of 2.5 should read between 50 to 200 mrem/hour on contact and 2.5 mrem/hour at one meter. A reading of 5 mrem/hour one meter from this type of package indicates potential damage.



Fissile material packages can be an exception. For these packages, the TI is often an assigned number, and there may be little correlation between the TI and the measurement taken at one meter. However, the reading at one meter should still be less than the listed TI if the package is undamaged. Fissile material shipments will be identified as such on shipping papers, and the TI number may be higher than a reading taken at one meter. For this reason, readings should only be used as a starting point for determining packaging integrity.

SHIPPING LABELS

After checking radiation levels at a package's surface, shippers will attach a radiation-warning label to the package, under guidelines that depend on the type and quantity of material being shipped and associated levels of radiation. Radiation-warning labels are attached to opposite sides of each package. Three different labels are used on packages: Radioactive White-I, Radioactive Yellow-II, and Radioactive Yellow-III.

notes

notes

Radiation-warning labels will specify the contents and the activity of the material inside the package. In addition, Radioactive Yellow-II and Radioactive Yellow-III labels also specify the TI.

Radioactive White-I

The Radioactive White-I label is attached to packages with extremely low levels of external radiation. The maximum contact radiation level associated with this label is 0.5 mrem/hour.

Radioactive Yellow-II

The Radioactive Yellow-II label is attached to packages with external radiation levels ranging from greater than 0.5 mrem/hour to no more than 50 mrem/hour.

The Radioactive Yellow-II label also has a box for the transport index. The maximum allowable transport index for this label is 1.

notes

Radioactive Yellow-III

The Radioactive Yellow-III label is attached to packages with external radiation levels ranging from greater than 50 mrem/hour to a maximum of 200 mrem/hour.

The maximum allowable transport index for this label is 10.

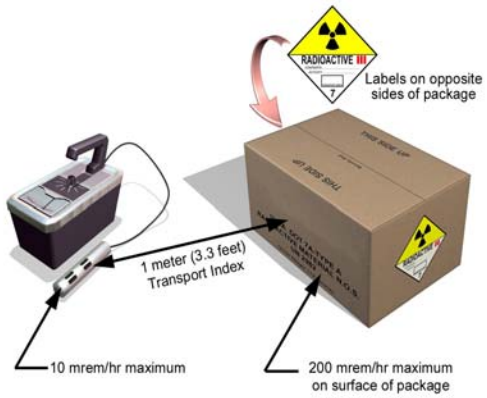
Catagory of Label	Maximum Contact Dose Rate	Maximum Dose Rate at 1 Meter
White-I	0.5 mrem/hr	N/A
Yellow-II	50 mrem/hr	1 mrem/hr
Yellow-III	200 mrem/hr	10 mrem/hr

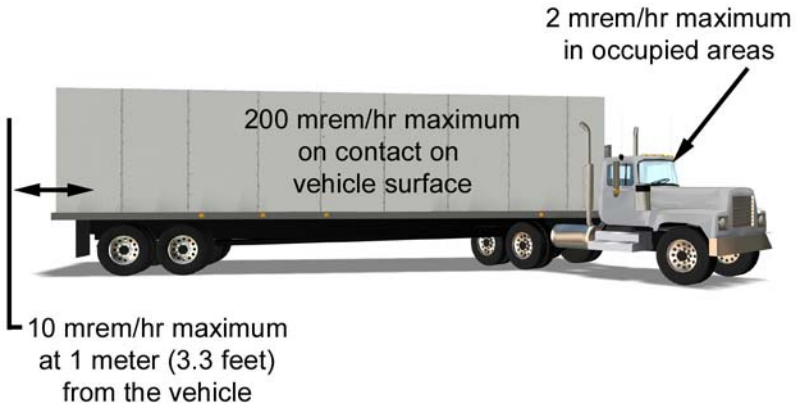
notes

PACKAGE AND VEHICLE RADIATION LIMITS

Radiation Limits on Packages and Vehicles in Non-exclusive Use Shipments

When radioactive material is transported non-exclusive use[2], each **package** must be designed and prepared for shipment so that the radiation level does not exceed 200 mrem/hour at any point on the external surface of the package, and the transport index does not exceed 10. Additionally, the **vehicle** transporting the material must be designed and prepared for shipment, so that the radiation level does not exceed 200 mrem/hour at any point on the external surface of the vehicle and the maximum radiation level at one meter from the transport vehicle does not exceed 10 mrem/hour. Radiation levels in occupied areas of the transport vehicle must not exceed 2 mrem/hour.





[2] "Exclusive use" describes a single consignor of a conveyance for which all initial, intermediate, and final loading and unloading are carried out in accordance with the direction of the consignor or consignee.

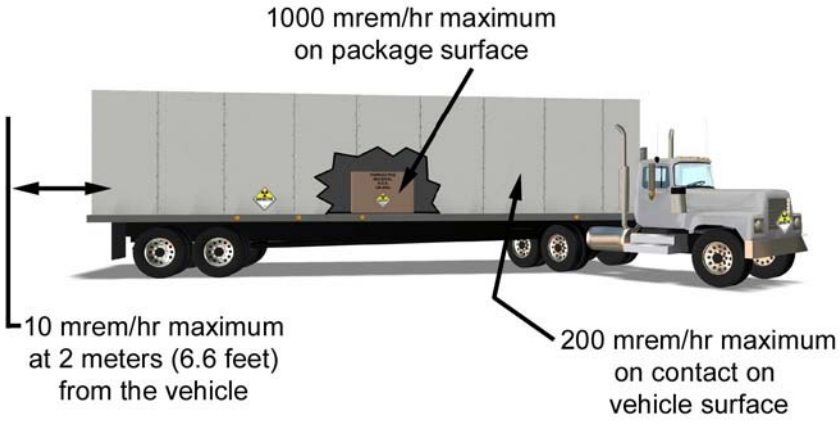
notes

Radiation Limits for Exclusive Use Vehicles

Packages that exceed the radiation levels previously mentioned must be transported by exclusive use. **Packages** in exclusive use vehicles may have radiation levels up to 1,000 mrem/hour on their exterior surface provided that:

a) the shipment is made in a Closed Transport Vehicle[3];
b) the package is secured within the vehicle so that its position remains fixed during transportation, and
c) there are no loading or unloading operations between the beginning and end of the transportation.

No point on the outer surfaces, or outer plane, of the vehicle may exceed 200 mrem/hour. Radiation levels at 2 meters from the vehicle cannot exceed 10 mrem/hour. Drivers of exclusive shipments are required to have specific written instructions for the shipment. These instructions must be included with the shipping papers.



Note: The only way you will know if a shipment is being transported under the exclusive use provisions is to look at the shipping papers, ask the driver and/or contact the shipper.

[3] Closed Transport Vehicle means a transport vehicle or conveyance equipped with a securely attached exterior enclosure that, during normal transportation, restricts the access of unauthorized persons to the cargo space.

Check Your Understanding

1. An undamaged package with a Radioactive White-I label can have a maximum radiation level of _____ mrem/hour at the surface of the package?
   a) 50 mrem/hour
   b) 200 mrem/hour
   c) 0.5 mrem/hour
   d) 20 mrem/hour

2. What is the transport index?
   a) In most cases, it's the maximum radiation level (measured in mrem/hour) at one meter from the undamaged package.
   b) The transport index is a number derived by taking the maximum weight of the package divided by the radiological dose rate.
   c) The contact dose rate on the packages inner container.
   d) A number representing the total number of packages allowed on the shipment.

3. The Radioactive _____ label is attached to packages with external radiation levels ranging from greater than 50 mrem/hour to a maximum of 200 mrem/hour.

4. The maximum radiation level on non-exclusive use vehicles is _____ mrem/hour.

5. The maximum contact radiation level allowed on packages transported inside exclusive use vehicles is _____ mrem/hour.

ANSWERS

1. c
2. a
3. Yellow-III
4. 200
5. 1,000

M E R R T T